# PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
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# PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| | |
|---|---|
| Date of mailing (*day/month/year*) | 16 FEB 2006 |
| Applicant's or agent's file reference<br>UWOTL 123636 | FOR FURTHER ACTION<br>See paragraph 2 below |

| International application No. | International filing date (*day/month/year*) | Priority date (*day/month/year*) |
|---|---|---|
| PCT/US04/32638 | 01 October 2004 (01.10.2004) | 03 October 2003 (03.10.2003) |

International Patent Classification (IPC) or both national classification and IPC

IPC(7): C25D 17/00 and US Cl.: 204/224R

Applicant

DANIEL SCHWARTZ

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| Name and mailing address of the ISA/ US | Date of completion of this opinion | Authorized officer |
|---|---|---|
| Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, Virginia 22313-1450<br>Facsimile No. (571) 273-3201 | 03 February 2006 (03.02.2006) | Nam Nguyen<br>Telephone No. 571-272-1342 |

Form PCT/ISA/237 (cover sheet) (April 2005)

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US04/32638

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ on paper

☐ in electronic form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in electronic form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US04/32638

**Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | |
|---|---|---|
| Novelty (N) | Claims 3,4 and 9-22 | YES |
| | Claims 1,2,5-8 | NO |
| Inventive step (IS) | Claims NONE | YES |
| | Claims 1-22 | NO |
| Industrial applicability (IA) | Claims 1-22 | YES |
| | Claims NONE | NO |

2. Citations and explanations:

Please See Continuation Sheet

**Supplemental Box**
In case the space in any of the preceding boxes is not sufficient.

**V. 2. Citations and Explanations:**
Claims 1, 2 and 5-8 lack novelty under PCT Article 33(2) as being anticipated by Hawkins et al.

Regarding claim 1, Hawkins et al. teach an inkjet print head 10 (figure 1) comprising: a plurality of electrodes 28a, 28b, 50a and 50b (figures 1 and 5e), each the electrode having a channel 26 therethrough; the electrodes are electrically connected through a voltage source by contacts (or leads) extending through the membrane 30 to the top surface of the print head 10 (column 9 lines 28-36; figure 5a); a high resistance means 20 for controlling the distribution of ink to the electrode channels; a resolution-defining layer 30 disclosed below a plurality of electrodes 50a and 50b, the resolution defining layer having a plurality of apertures 26 that provides and outflow path for the ink. Although the print head of Hawkins et al. is used for ejecting ink, the print head is structurally capable for use in electrolytically depositing material onto a substrate, and thus the preamble of using the print head to electrolytically deposit a material is not given weight because it is an intended use of the instant invention.

Regarding claim 2, Hawkins et al. teach a printer head having an ink reservoir 20 which is broadly interpreted to read on the high electrical resistance means with a plenum.

Regarding claim 5, Hawkins et al. teach a printer head having a mounting block 12 as the support structure.

Regarding claims 6-7, Hawkins et al. teach a printer head wherein the electrodes are large relative to the apertures in the resolution defining layer (the electrodes have a wider diameter than the channels, figure 3c), and the electrodes are electroplated with steel (column 8 lines 42-45).

Regarding claim 8, Hawkins et al. teach a printer head is made from a plurality of precut layers of material that are assembled and bonded together (figure 1).

Claims 3, 9-11 and 13-21 lack an inventive step under PCT Article 33(3) as being obvious over Hawkins et al. in view of Hunter et al.

Regarding claims 9 and 17, Hawkins et al. teach a method of improving the control in the directionality of ink drops of an inkjet print head 10 (figure 1), the print head comprising: a plurality of electrodes 28a, 28b, 50a and 50b (figures 1 and 5e), each the electrode having a channel 26 therethrough; the electrodes are electrically connected through a voltage source by contacts (or leads) extending through the membrane 30 to the top surface of the print head 10 (column 9 lines 28-36; figure 5a); a high resistance means 20 for controlling the distribution of ink to the electrode channels; a resolution-defining layer 30 disclosed below a plurality of electrodes 50a and 50b, the resolution defining layer having a plurality of apertures 26 that provides and outflow path for the ink. Although the print head of Hawkins et al. is used for ejecting ink, the print head is structurally capable for use in electrolytically depositing material onto a substrate, and thus the preamble of using the print

**Supplemental Box**
**In case the space in any of the preceding boxes is not sufficient.**

head to electrolytically deposit a material is not given weight because it is an intended use of the instant invention.

The reference to Hawkins et al. differs from the instant claims in that the reference does not explicitly teach a conductive substrate (claims 9); nor an actuator for moving the conductive substrate (claim 9). Hawkins et al. also do not teach the method of providing a conductive substrate and selectively applying an electrode potential between the electrodes and the conductive substrate (claim 17); nor varying the flow rate of the electrolyte and the electric potential (claim 17).

Hunter et al. teach a method for producing a three-dimensional object, comprising the steps of providing a conductive substrate, an electrode and a solution. Local deposition of the material is achieved by passing a current between the electrode the substrate to the solution. Relatively moving the electrode and a substrate along a selected trajectory using motors and actuators (column 7 lines 12-15), and locally depositing in the process, enables the fabrication of a three-dimensional object (column 4 lines 50-65). Additionally, Hunter et al. teach that multiple electrodes can also be provided (column 5 lines 15-27); varying the potential to selectively deposit different materials (column 5 lines 5-10); and applying pressure to the solution to vary the flow rate (column 9 lines 30-32).

Addressing claim 9, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the apparatus of Hawkins et al. by using the conductive substrate of Hunter et al., because using a conductive substrate would enable an electric current to pass through the electrolytic solution between the electrode and the substrate, thus allowing the deposition of a metallic material. The print head of Hawkins et al. is used for applying an ink droplet on a paper medium. It is known in the art of inkjet printing to move the substrate during the printing process. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention to have modified the apparatus of Hawkins et al. by moving the conductive substrate, because it would allow the construction of features having a wide range of structure geometries and areas.

Addressing claim 17 and 19, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Hawkins et al. by using the conductive substrate of Hunter et al., because using a conductive substrate would enable an electric current to pass through the electrolytic solution between the electrode and the substrate, thus allowing the deposition of a metallic material. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Hawkins et al. by varying the flow rate and electric potential as taught by Hunter et al., because varying the flow rate increases the mass transfer and produces deposit structures exhibiting superior properties, including density and adhesion (column 9 lines 18-23), and because varying electric potential allows different materials to be deposited (column 5 lines 5-10).

Addressing claims 18 and 20, it would have been obvious to one having ordinary skill in the art at the time the invention to have modified the method of Hawkins et al. by moving the conductive substrate in the horizontal and vertical directions, because it would allow the construction of features having a wide range of structure geometries and areas. Hunter et al. teach that the distance between the orifice and the surface determines the resolution. It would have been obvious to one having ordinary skill in the art to modify this distance in order to achieve the desired resolution or feature size.

Regarding claim 10, Hawkins et al. teach a printer head having an ink reservoir 20 which is broadly interpreted to read on the high electrical resistance means with a plenum.

Regarding claim 3, 11 and 21, Hawkins et al. teach a printer head having a crosstalk inhibitor 14 which is disposed between the plenum and the plurality of electrodes. Although Hawkins et al. is silent to the material construction of the structure 14, it would have been obvious to one having ordinary skill in the art to have made the structure of an insulating material in order to electrically isolate it from the electrodes.

Regarding claim 13, Hawkins et al. teach a printer head having a mounting block 12 as the support structure.

Regarding claims 14-15, Hawkins et al. teach a printer head wherein the electrodes are large relative to the apertures in the resolution defining layer (the electrodes have a wider diameter than the channels, figure 3c), and the electrodes are electroplated with steel (column 8 lines 42-45).

Regarding claim 16, Hawkins et al. teach a printer head is made from a plurality of precut layers of material that are assembled and bonded together (figure 1).

Claim 4 and 12 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in the immediately preceding paragraph and further in view of Schwartz et al.

Hawkins et al. and Hunter et al. differs from the instant claims in that the references do not explicitly teach a print head

**Supplemental Box**
**In case the space in any of the preceding boxes is not sufficient.**

having a flow distribution layer attached to the ink reservoir or plenum.

Schwartz et al. teach a system and method for electroforming a metal layer on a substrate using an apparatus comprising a diffuser 30 (figure 1), or flow distribution layer, having a plurality of openings. The diffuser directs the electrolyte to an anode housing or basket (column 4 lines 15-21) and provides a uniform distribution of the electrolyte to the anode electrode.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the apparatus and method of Hawkins et al. and Hunter et al. by incorporating the diffuser of Schwartz et al., because it would provide a uniform distribution of the electrolyte to the electrode, thus creating a uniform flow and pressure of the electrolyte to the individual nozzles.

Claim 22 lacks an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in the immediately preceding paragraph and further in view of Cohen.

Hawkins et al. and Hunter et al. differs from the instant claims in that the references do not explicitly teach removing the sacrificial layer.

Cohen teach an electroplating method for forming a three-dimensional structure by depositing a structural metal and a sacrificial metal layer (figure 11a-m). The deposition is repeated using a conformal mask, and after the completion of the deposition process, the sacrificial metal layer is etched to form the three-dimensional structure (column 13 lines 23-39).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Hawkins et al. and Hunter et al. by removing the sacrificial metal as taught by Cohen, because removing the sacrificial metal would form voids or channels to create a three-dimensional structure. A sacrificial metal as implied by the name is removed after the completion of the deposition process in order to reveal the predetermined structure.